

ICE-85™ MCS-85™ IN-CIRCUIT EMULATOR

Connects the Intellec® System Resources to the user-configured system via a 40-pin adaptor plug

Executes user system software in real-time

Allows user-configured system to share Intellec® memory and I/O facilities

Provides 1023 states of 8085 trace data plus 18 additional logic signals via an External Trace Module

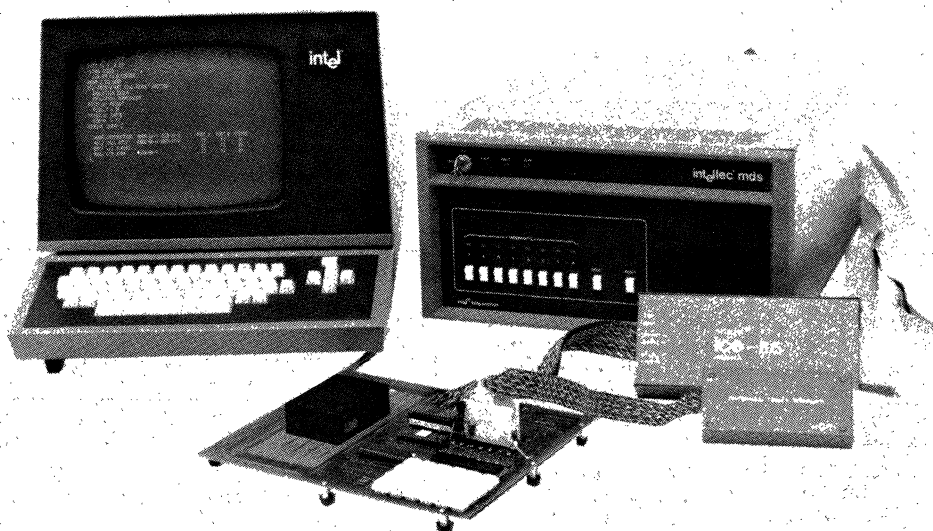
Offers full symbolic debugging capability for both assembly language and Intel's high-level compiler language, PL/M-80

Displays trace data from the user's 8085 in assembler mnemonics and allows personality groupings of data sampled by the external 18-channel trace module

Extends ICE capabilities to the rest of the prototype system peripheral circuitry by allowing the user to execute his own peripheral chip analysis routines

Provides ability to examine and alter MCS-85™ registers, memory, flag values, interrupt bits and I/O ports

The ICE-85 module resides in the Intellec® Microcomputer Development System and interfaces to the user system's 8085. In addition, an external trace module provides access to user system peripheral circuitry via a user-configured DIP clip for peripheral ICs or may be attached to as many as 18 separate prototype signal nodes via individual probe clips. Using the ICE-85 module, the designer can execute prototype software in real-time or single-step mode and can substitute Intellec® system memory and I/O for user system equivalent. ICE capability can be extended to the rest of the user system peripheral circuitry by allowing the user to create and execute a library of user-defined peripheral chip analyzer routines. All user access to the prototype system software may be done symbolically by assigning names to program locations and data, I/O ports and groups of external trace signals. For the first time, in-circuit emulation extends beyond the user's prototype CPU to the entire user's system, allowing In-System Emulation.



SYMBOLIC DEBUGGING CAPABILITY

ICE-85 allows the user to make symbolic references to I/O ports, memory addresses and data in his program. Symbols and PL/M statement number may be substituted for numeric values in any of the ICE-85 commands. The user is relieved from looking up addresses of variables or program subroutines.

The user symbol table generated along with the object file during a PL/M-80 compilation or by the ISIS-II 8080/8085 Macro Assembler is loaded into the Inteltec® System memory along with the user program which is to be emulated. The user may add to this symbol table any additional symbolic values for memory addresses, constants, or variables that are found useful during system debugging. By referring to symbol memory addresses, the user can examine, change or break at the intended location.

ICE-85 provides symbolic definition of all 8085 registers, interrupt bits and flags. The following symbolic references are also provided for user convenience: **TIMER**, the low-order 16 bits of a register containing the number of 2 MHz clock pulses elapsed during emulation; **HTIMER**, the high-order 16 bits of the timer counter; **PPC**, the address of the last instruction emulated; **BUFFERSIZE**, the number of frames of valid trace data (between 0 and 1022).

PERSONALITY GROUPED DISPLAYS

Trace data in the 1023 by 42-channel real-time trace memory buffer is displayed in easy to read format. The user has the option to specify trace data displays in actual 8085 assembler instruction mnemonics. The data collected from the External Trace Module can be grouped and symbolically named according to user specifications and displayed in the appropriate number base designation. Simple ICE-85 commands allow the user to select any portion of the 42K-bit trace buffer for immediate display.

MEMORY AND I/O MAPPING

Memory and I/O for the user system can be resident in the user system or "borrowed" from the Inteltec® System through ICE-85's mapping capability.

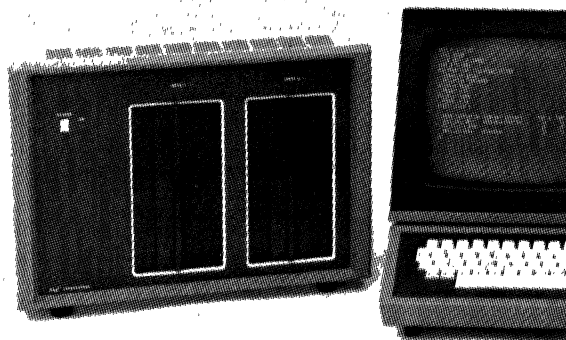
ICE-85 separates user memory into 32 2K blocks. Each block of memory can be defined independently. The user may assign Inteltec® System equivalents to take the place of devices not yet designed for the user system during prototyping. In addition, Inteltec® System memory or I/O can be accessed in place of suspect user system devices during prototyping or production checkout.

The user can also designate a block of memory or I/O as nonexistent. ICE-85 issues error messages when memory or I/O designated as nonexistent is accessed by the user program.

INTEGRATED HARDWARE/SOFTWARE DEVELOPMENT

The user prototype need consist of no more than an 8085 CPU socket and a user bus to begin integration of software and hardware development efforts. Through ICE-85 mapping capabilities, Inteltec® System equivalents can be accessed for missing prototype hardware. Hardware designs can be tested using the system software which will drive the final product.

The system integration phase, which can be so costly when attempting to mesh completed hardware and software products, becomes a convenient two-way debug tool when begun early in the design cycle.



TYPICAL ICE INTERROGATION AND UTILITY COMMANDS

DISPLAY/CHANGE	Display/Changes the values of symbols and the contents of 8085 registers, pseudo-registers, status flags, interrupt bits, I/O ports and memory.
EVALUATE	Displays the value of an expression in the binary, octal, decimal or hexadecimal.
SEARCH	Searches user memory between locations in a user program for specified contents.
CALL	Emulates a procedure starting at a specified memory address in user memory.
ICALL	Executes a user-supplied procedure starting at a specified memory address in the Inteltec® System memory.
EXECUTE	Saves emulated program registers and emulates a user-supplied subroutine to access peripheral chips in the user's system.

REAL TIME TRACE

ICE-85 captures valuable trace information from the emulating CPU and the External Trace Module while the user is executing programs in real time. The 8085 status, the user memory or port addressed, the data read or written, the serial data lines and data from 18 external signals, is stored for the last 1023 machine states executed (511 machine cycles). This provides ample data for determining how the user system was reacting prior to emulation break. It is available whether the break was user-initiated or the result of an error condition.

For detailed information on the actions of CPU registers, flags, or other system operations, the user may operate in single or multi-step sequences tailored to system debug needs.

EXTERNAL TRACE MODULE

TTL level signals from 18 points in the user system may be synchronously sampled by the External Trace Module and collected in ICE-85's trace buffer. The signals can be collected from a single peripheral chip via the supplied 40-pin DIP clip or may be placed by the user on up to 18 separate signal nodes using the supplied 18 individual probe clips. These signals are included in the 42-channel breakpoint comparisons and clock qualifiers. Also, data from these 18 channels may be displayed in each to read, user-defined groupings.

SYNCHRONOUS OPERATION WITH OTHER DESIGN AIDS

ICE-85 can be synchronized with other Intellec® design aids by means of two external synchronization lines. These lines are used to enable and disable ICE-85 trace data collection and to cause break conditions based on an external signal which may not be included in the ICE-85 breakpoint registers. In addition, ICE-85 can generate signals on these lines which may be used to control other design aids.

BREAK REGISTERS/TRACE MEMORY

ICE-85 has two breakpoint registers which are used to break emulation, and two trace qualifier registers which are used to control the collection of trace data during emulation. Each register is 42 entries wide, one entry for each channel and each entry can take any one of the three values 0, 1 or "don't care".

The trace buffer, also 42 entries wide, collects data sampled from 24 8085 processor channels and 18 external channels sampled by the External Trace Module. The signals collected from the 8085 include address lines, data lines, status lines and serial input and output lines. The 18 channels extending from the External Trace Module synchronously sample and collect into the trace buffer any user-specified TTL compatible signal from the rest of the prototype system. "Break" and "trace qualification" may therefore occur as a result of a match of any combination of up to 42 channels of CPU and external circuitry signals.

EMULATION CONTROLS AND COMMANDS

GROUP	Defines into a symbolically named group, a channel or combination of channels from the 8085 Microprocessor and/or the External Trace Module.
GO	Initiates real-time emulation and controls emulation break conditions.
STEP	Initiates emulation in single instruction steps. User may specify the type and amount of information displayed following each step, and define conditions under which stepping should continue.
PRINT	Prints the user-specified portion of the trace memory to the selected list device.

SPECIFICATIONS

ICE-85 OPERATING ENVIRONMENT

Diskette-Based ICE-85 Software

Required Hardware:

Intellec® Microcomputer Development System
System Console
Intellec® Diskette Operating System
ICE-85 Module

Required Software:

System Monitor
ISIS-II

EQUIPMENT SUPPLIED

18-Channel External Trace Module
Printed Circuit Boards (2)
Interface Cable and Emulation Buffer Module
Operator's Manual
ICE-85 Software, Diskette-Based Version

EMULATION CLOCK

User's system clock or ICE-85 adaptor socket
(6.144 MHz Crystal)

PHYSICAL CHARACTERISTICS

Printed Circuit Boards:

Width: 12.00 in. (30.48 cm)
Height: 6.75 in. (17.15 cm)
Depth: 0.50 in. (1.27 cm)
Packaged Weight: 6.00 lb (2.73 kg)

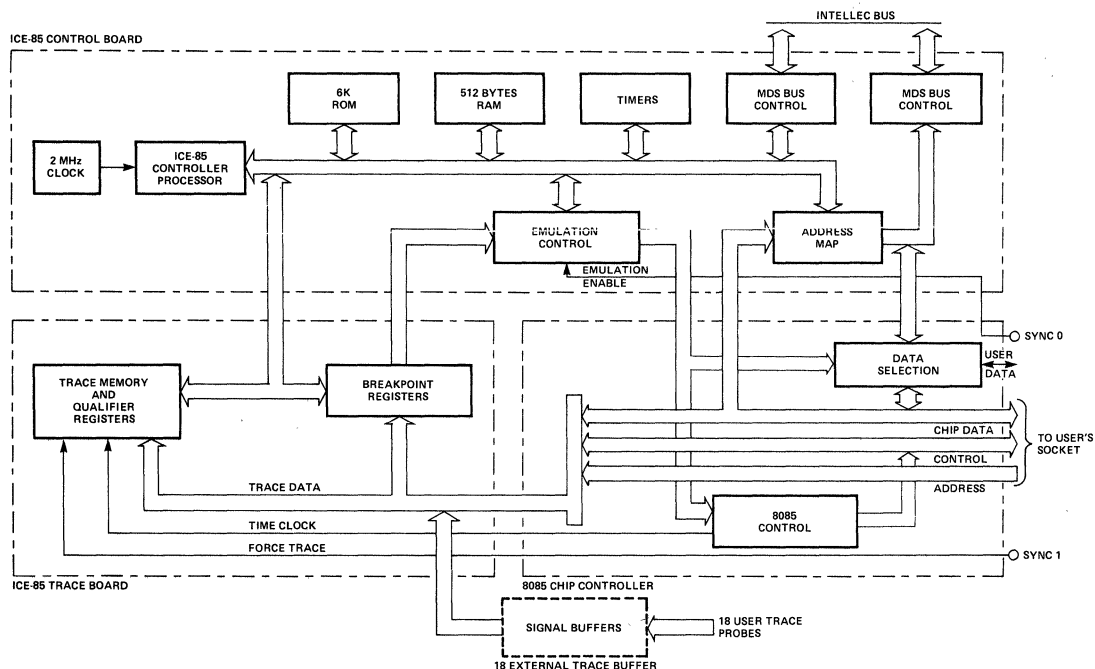
ELECTRICAL CHARACTERISTICS

DC Power:

$V_{CC} = +5V \pm 5\%$
 $I_{CC} = 12A$ maximum; 10A typical
 $V_{DD} = +12V \pm 5\%$
 $I_{DD} = 80$ mA maximum; 60 mA typical
 $V_{BB} = -10V \pm 5\%$
 $I_{BB} = 30$ mA maximum; 10 μA typical

ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: 0° to 40°C
Operating Humidity: Up to 95% relative humidity without condensation.



ICE-85 BLOCK DIAGRAM

ORDERING INFORMATION

Part Number	Description
MDS-85-ICE	8085 CPU In-Circuit Emulator and 18-Channel External Trace Module